

mounted to the interior surface of the gas turbine engine casing 11 and disposed proximate to the bypass air valve 20 in order to selectively actuate the liner 40 circumferentially, that is, rotate the liner 40 about the turbine engine component. The means for selectively circumferentially actuating 48 may have a strap 50 in contact with the liner 40, and also include pair of spring assemblies 70 and disposed in contact with the strap 50. Each spring assembly 70 may include a spring 72, a bolt 74, and a nut 76. The bolt 74 may extend through the spring 72 and through clearance holes in the first and second flanges 62, 64. The spring 72 may act between the bolt 74 and nut 76 assembly and the outer surfaces 78, 80 of one of the flanges 62, 64. The springs 72 are shown acting between the nuts 76 and the outer surface 78 of the first flange 62. The means for selectively circumferentially actuating 48 may include an arm 52 and a driver 54. The arm 52 may include a first outer bar 56, a second outer bar 58, and a middle bar 60 disposed between the outer bars 56, 58. The outer bars 56, 58 may be spaced equidistant from the middle bar 60. A first flange 62 of the strap 52 is disposed between the middle bar 60 and the second outer bar 58. A second flange 64 of the strap 52 may be disposed between the middle bar 60 and the first outer bar 56. An end 66 of the arm 52 opposite the bars 56, 58, 60 may be pivotally attached to the driver 54. The arm 52 may further include a joint 68 to accommodate any misalignment between the driver 54 and the strap 50 connected to the liner 40 of the present disclosure.

[0031] When the bypass air valve 20 is actuated toward the open position, the driver 54 drives the arm 52 in a direction substantially tangential to the circumference of the liner 40. As a result, the middle bar 60 may contact the first flange 62 and drive a segment of the strap 50 out of contact with the liner 40 (see FIG. 8B). The length of the segment depends upon the stiffness of the strap 50 and the magnitude of the forces biasing the strap 50 against the liner 40. After the strap segment has been disengaged from the liner 40, the strap 40 will be translated by either the spring assemblies 70 drawing the second flange 64 in the same direction, or by the first outer bar 56 contacting the second flange 64. After the strap 50 is translated to the open position, the spring assemblies 70 and the pressure against the strap 50 will bias the strap 50 against the liner 40 (see FIG. 8C).

[0032] When the bypass air valve 20 is actuated toward the closed position, the driver 54 drives the arm 52 in a direction opposite that taken to open the bypass air valve 20. In doing so, the middle bar 60 may contact the second flange 64 and drive a segment of the strap 50 out of contact with the liner 40 (see FIG. 8D). The strap 50 may be subsequently translated by either the spring assemblies 70 drawing the first flange 62 in the same direction, or by the second outer bar 58 contacting the first flange 62. After the strap 50 is translated to the open position, the spring assemblies 70 and the pressure against the strap 50 bias the strap 50 against the liner 40 (see FIG. 8A).

[0033] Using the means for selectively actuating the bypass air valve 20, the liner 40 may be selectively actuated into an open position where the plurality of apertures 42 of the liner 40 may be substantially aligned with the plurality of apertures 37 of the surface(s) 25, 31, 33, 47 of the turbine engine components. The alignment permits transfer flow 36 taken from the fan exhaust stream flow to pass through liner 40 via the plurality of apertures 42 and apertures 37 and enter the turbine exhaust stream at flow transfer location 34. As a result, a decreased fan stream exhaust flow makes the fan bypass nozzle area appear relatively larger, while the

increased turbine exhaust stream flow makes the turbine exhaust nozzle area appear relatively smaller. The liner 40 may also be selectively actuated into a closed position, where the at least one impermeable region 44 may be substantially aligned with the apertures 37 thereby impeding and/or ceasing the transfer flow 36 from entering the turbine exhaust stream.

[0034] FIG. 10 illustrates the favorable impact upon fan operation of increasing bypass air valve flow. As bypass air valve flow is increased, the favorable pressure gradient for bypass air valve flow is reduced. FIG. 11 illustrates the reduction in liner pressure ratio that results with increasing bypass air valve flow. This reduction in liner pressure ratio limits the bypass air valve flow, but the available pressure ratio may be favorably influenced by the choice of thermodynamic cycle chosen for the engine and by the selection of the location where bypass air valve flow is injected into the turbine exhaust stream flow. As shown in FIG. 11, a fraction of the fan exhaust stream flow is increased by approximately 10% and a ratio of a fan exhaust stream pressure to a turbine exhaust stream pressure is in turn reduced by approximately 30%. FIG. 12 illustrates how the available liner pressure ratio may be increased by selecting a thermodynamic cycle that produces a higher turbine expansion ratio. As shown in FIG. 12, as design bypass ratio is increased from approximately 15.5 to approximately 17.2 the ratio of fan exhaust stream pressure to a turbine exhaust stream pressure is increased by approximately 30%. FIG. 13 illustrates how bypass air valve flow may be injected into the turbine exhaust stream flow at a higher velocity location to increase the available liner pressure ratio. As shown in FIG. 13, as Mach Number is increased from approximately 0.1 to approximately 0.65 the ratio of total pressure to static pressure is increased by approximately 30% at the flow transfer location.

[0035] One or more embodiments of the present invention have been described. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of the invention. Accordingly, other embodiments are within the scope of the following claims.

What is claimed is:

1. A turbine engine component of a turbofan engine fitted with a bypass air valve, comprising:
 - at least one turbine engine component having a surface with at least one aperture, said turbine engine component located from between a bypass fan duct and a turbine exhaust nozzle of the turbofan engine;
 - a bypass air valve comprising:
 - a liner concentrically disposed about said turbine engine component and parallel to a centerline of the turbofan engine, said liner having a surface including at least one aperture and at least one impermeable region, and
 - means for actuating said liner about said turbine engine component; and
 - a flow transfer location comprising an area proximate to a turbine exhaust stream flow.
2. The turbine engine component of claim 1, wherein said means for actuating comprises means for rotating said liner about said turbine engine component.
3. The turbine engine component of claim 1, wherein said means for actuating comprises means for moving said liner in a forward direction or a backward direction parallel to the centerline along said turbine engine component.